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Content of an in-service training to develop and assess activities minding critical thinking

Atilla Çimer [a], Melih Timuçin [b]*

[a] *KTU, Fatih Faculty of Education, Secondary School Science and Mathematics Fields Education Biology Department, 61335 Söğütlü, Trabzon/Türkiye*

Abstract

Ministry of National Education Turkey (MoNET) has undergone some substantial changes in primary and secondary school courses curricula. The former notion of the curricula has replaced with the constructivist learning theory based curricula starting from primary education courses to upward since the beginning of the millennium. This 'paradigm shift' required fundamental changes in terms of student and teacher roles, assessment methods and learning products. Some studies implied that besides some other skills, Turkish teachers should be supported in terms of nomenclature and teaching of Higher Order Thinking Skills (HOTS). Critical Thinking (CT) skill is one of the most important of the HOTS. In this study an in-service training was devised to support Biology teachers in terms of CT terminology, preparing activities that more properly emphasize on CT aspects, and objective assessment of CT skills. The in-service training course content will be shaped by the literature, teacher and expert feedbacks about the prepared content and the pilot application of the course. The main application of the course will be performed in the early 2011 on national or local level.

Keywords: Critical Thinking, Biology, In-service training, critical thinking materials, critical thinking assessment

1. Introduction

Through the last decade, Turkish primary and secondary school curricula have been revised fundamentally with contemporary educational theories based approaches. Constructivist Learning Theory has always been the hub of this paradigm shift. Constructivist Learning Theory based curricula require letting students construct their own knowledge by orienting them with previous knowledge. Assessing students with activities below their cognitive potential, hinder them to use HOTS (Çepni *et.al*, 2002; Çepni *et.al,* 2003). The assessment applied to students have potential to increase and shape student learning (William& Black, 1998). So, lest the system eventually not turn back into traditional one, constructivist learning environments are supposed to be student centered and facilitate active learning which dictates continuous monitoring different types of student performances in a formative manner.

Detecting and valuing the HOTS is another must of this meaningful learning. Unquestioningly, every educational process somehow has critical and creative elements. However, without providing a proper training, expecting teachers to include HOTS elements in activities and assessing students in terms of HOTS systematically and effectively, is not realistic.

Although critical thinking (CT) is one of the most frequently mentioned and best isolated HOTS, its definition and implications are still controversial. Dewey (1910) defined it as *"reflective thought"-to suspend judgment,*

* Melih Timuçin. Tel.: +90 505 356 58 94
E-mail address: meltimuciin@gmail.com

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maintain a healthy skepticism, and exercise to an open mind (cited by URL4). Kuhn (1999) compared several CT definitions and underlined that what we call CT is actually a set of metacognitive strategies fostering CT. The statements of Kuhn (1999) and Willingham (2007) imply that things we do to improve CT, actually building metacognitive arcs for thinking run but they do not guarantee amount of water or even whether water would flow. We do not undermine the meaning of Kuhn (1999) and we will refer those metacognitive strategies especially when we say *improving CT* and *CT education*.

Although Turkish codes and curricula literally care and frequently mentioned HOTS, CT and precise assessment tools to track these skills, studies showed that there are problems related to application of performance assessment and other formative assessment means like; self and peer assessment and portfolio (Çimer 2004, Timucin 2008, Çimer& Timuçin 2008)

2. Method

The content of the in-service training was prepared with a literature review. The review had several stages starting from systematic review of the thesis prepared in Turkey (Çimer& Timuçin 2009) and history of CT (Timuçin 2009). The review shaped into the content by considering the requirements of the present Biology classrooms. The pilot of the in-service training will be conducted with a group of 6 which is composed of 3 graduate students at Karadeniz Technical University Fatih Faculty of Education Biology Department (may be teaching at the same time) and 3 active Biology teachers with 5-10 years teaching experience. During the study the graduate students will be matched with teachers and form 3 groups to increase the efficiency of the study. The participants, provided with different types of sample CT activities and rubrics, will be expected to produce similar CT activities and rubrics for their assessment in their group to appeal 9th grade Biology course. Then these activities will be applied in the classrooms of the active biology teachers. Some trademark CT scales and a CT interview will be applied as pre and post to determine the efficiency of the in-service training. The content and the application will be revised along with the data coming from the interviews of the participants and the observations of the lecturers. Finally, an extensive in-service training will be offered to the Ministry of National Education Turkey (MoNET) as a central in-service training to develop and assess activities minding CT.

3. Findings (The Content)

3.1. Lead in

Obviously, the content starts with basics of CT like what it is, why it is necessary, basic terms, other HOTS *etc*. In the core part there are active learning activities that have potential to induce CT and forming rubrics to assess such activities or student performance through a set of such activities; through a Biology class in other words.

3.2. Activities Minding Critical Thinking

Active learning strategies improves CT by triggering cognitive processes (Youngblood ve Beitz, 2001).
First thing to say about these activities that there can be a myriad of such activities more and not all of them are scientifically approved activities to improve CT. We just chose some samples as good as we can and applied on some experts opinions. There are several classifications of activities and CT activities. For example: Buranapatana (2006) divided them as; *real life problems, activities and dialogues with group*. Similarly, Potts (1994) determined the strategies to improve CT as *building categories, determining problems and enriching environment*. Since there were a lot of activities in our list, we needed a further classification with respect to our perspective and we came up with these groups:

a. *Texts inquiring CT elements* (*e.g.* assessing assumptions, induction, deduction, finding contradictions, classification and interpretations *etc.*): We think these texts are one of the best ways of tracing various CT elements on students. Their best examples are the items of some commercial CT tests. We are refraining from advertising such commercial goods but we sincerely believe that a thumb over such tests by teachers and may be

even students will provide wider vision for future instructions. We offer similar texts in biology field. A deduction example is below:

Example: A living thing X has chlorophil. X does not have chloroplasts. So:

Assumptions	Can be concluded	Cannot be concluded
1. X is unicellular.	()	()
2. X is a fungus.	()	()
3. X does not have nuclear membrane.	()	()

b. *Activities to associate the content with real life* (*e.g.* ill-structured problems, thinking journals and Thinking Aloud Pair Problem Solving *(TAPPS) etc*.): Associating the knowledge provided with the curricula with the real life is the ultimate purpose of education. So, the content of the lesson should relate real life as much as possible.
c. *Reflective thinking and consolidation activities* (*e.g.* one-minute papers, jigsaw reading and question and answer pairs *etc*.): In some resources reflective thinking is referred as another HOTS. Still, considering overlapping natures of different cognition types, we can still have reflective thinking as a source feeding CT.
d. *Debates* (*e.g.* micro themes, sending problems, and think, pair and share): Debates are real life projections of almost all CT elements. In a healthy debate there should be arguments, counterarguments, assumptions, conclusions.
e. *Activities appealing different intelligence types* (cartoons, creative drama): In *Habits of Mind* Costa and Kallick (2005) mentioned *gathering data through all senses* as 8th habit of mind and a feature of good thinking. Actually, including another intelligence type frequently reveals new horizons.
f. *Activities to share aims* (wish tree, matching aims (students' with teacher's): Sharing aims is important element of teaching CT (Paul *et.al.* 1990)
g. *Socratic questioning*: More than a type of activity, it is a clearly defined instructional strategy, even sometimes called a method. ***Socratic Method*** is defined *as a dialectic method of inquiry, which uses cross-examination of someone's claims and premises in order to reveal out a contradiction or internal inconsistency among them* URL1. Paul examined the application of the Socratic questioning in educational setting and gave a sample classroom dialogue. In URL3 Paul and his friends explained how Socratic questioning could be applied in classroom setting. They say the best way to trigger and carry on such dialogue in the classroom for a teacher is writing the main question to discuss in the first place. Then he/she should find *a prior question*, the answer of which will somehow lead the first question. So teacher should reach a long list of chain of prior questions to ask in the classroom as in the example below:

- *What is history?*
- *What do historians write about?*
- *What is the past? (And so on…)*

The list is just a guide, of course, and it does not need to be followed strictly.

3.3 Assessing Critical Thinking

Ennis (1993) and Stein *et.al*. (2003) reviewed popular CT scales. Apparently, because of the volatile and overlapping with other HOTS nature of CT, all tests exhibit variety of weaknesses.
Studies showed that teachers in Turkey are encountering problems related to applying proper performance assessment, which is one of the most important requirements of the new curricula (*see* Introduction).
Concerning the factors above, we offer teachers to use self-prepared rubrics. We believe rubrics prepared considering the needs of a specific region, school, classroom – tailor made rubrics, in other words, are the best. We provide different samples (rubrics directly offered by the curricula, rubrics taken from open internet sources, rubrics prepared by the researchers) and resources. The resources we offer, to use as a map while determining criteria in rubrics, were higher order target objectives determined by secondary school curricula (MoNET 2007, 2008a, 2008b, 2009), 35 dimensions of CT (Paul *et.al.*, 1990) and elements of thought (Paul *et.al.*, 1990).
The Biology course curricula determined intended student attainments under three titles. Below, you will find these titles and a couple of examples for the higher order attainments under the related title:

a. ***Science-Technology-Society-Environment Attainments (BTTÇ[2])***
   BTTÇ1. Understand[3] the role of science in terms of sufficing social needs
   BTTÇ2. Understand that science has a nature that can be examined, questioned, falsified and supported with evidences
   BTTC4. Explain the role of evidences, theories and/or paradigms in the improvement of scientific knowledge…BTTC33
b. ***Communication Skills, Attitudes and Values (İTD)***
   İTD2. Have the habit of applying learning to learn
   İTD5. Stick to authenticity as a principal in observations and experiments
   İTD6. Try to understand others' feelings and opinions correctly by putting themselves into their place…İTD20
c. ***Scientific Research& Scientific Process Skills (BAS)***
   BAS2. Use, explain and/or form various classification criteria
   BAS3. Draw various anticipations related to biological phenomena
   BAS4. Make predictions based on reliable and precise data… BAS27

Paul *et.al.* (1990) determined 35 basic dimensions (or skills) of CT. You will find 3 titles and a couple of examples under them

a. ***Affective strategies***
   S-*1 thinking independently,*
   S-2 developing insight into egocentricity or sociocentricity
   S-3 exercising fair-mindedness … S-9
b. ***Cognitive Strategies - Macro-Abilities***
   S-10 refining generalizations and avoiding oversimplifications
   S-11 comparing analogous situations: transferring insights to new contexts
   S-12 developing one's perspective: creating or exploring beliefs, arguments, or theories …S-26
c. ***C. Cognitive Strategies - Micro-Skills***
   S-27 comparing and contrasting ideals with actual practice
   S-28 thinking precisely about thinking: using critical vocabulary
   S-29 noting significant similarities and differences …S-35.

Finally, Paul *et.al.* (1990) determined *the Elements of Reasoning* as: *purpose, questions and problems, point of view, knowledge, implication and consequence, concepts, and assumptions*. They also defined *Intellectual Standards* as *clarity, relevancy, meaningfulness, integrity, sensibility, authenticity, and depth*. They argued that good thinking is applying *Intellectual Standards* onto *Elements of Reasoning* in an appropriate way. We think that it is a good database for writing criteria directly related to CT and other HOTS. For example, you may write sentences by taking one suitable word from each set: *The student was clear in his/her assumptions etc*.

3.4. Rubrics

After the criteria are written in the related field, achievement degrees should be determined in the most concrete way possible by using numbers and other possible objective things. Some methods of completing the total rubric score to a whole number will be offered. In the notion of the formative assessment rubrics are not only measuring means, so they had better be shared with students in order to motivate and orient them (Çimer, 2004).

4. Suggestions

We believe in authenticity. So, once again we would like to underline the vitality of the teachers' carrying authentic things into classrooms or even carrying classroom into authenticity safely but as much as possible. Thus we suggest boosting authentic, ill-structured problem lessons, forming web sites presenting such activities and sharing problem banks in all fields.

[2] Abbreviations in Turkish.
[3] Although the attainments start with Understand and Explain words, to comprehend defined tasks is still higher order.

We suggest being objective-oriented to researchers of similar studies. Whatever material you are preparing, the scaffolding should come from a concrete theory base. We are not asserting the sources above but teachers should define extensive criteria covering all related domains not only for preparing and assessing CT materials but also for distributing any piece of instruction.

Dealing directly with curricula and starting from them both prevents waste of time and makes the deeds much more valid.

We believe that there should be studies comparing overall CT skill, disposition or belief levels of individuals with field (e.g. biology, physics etc.) specific CT entities. We are eager and open to conduct such studies cross-culturally.

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